

1000

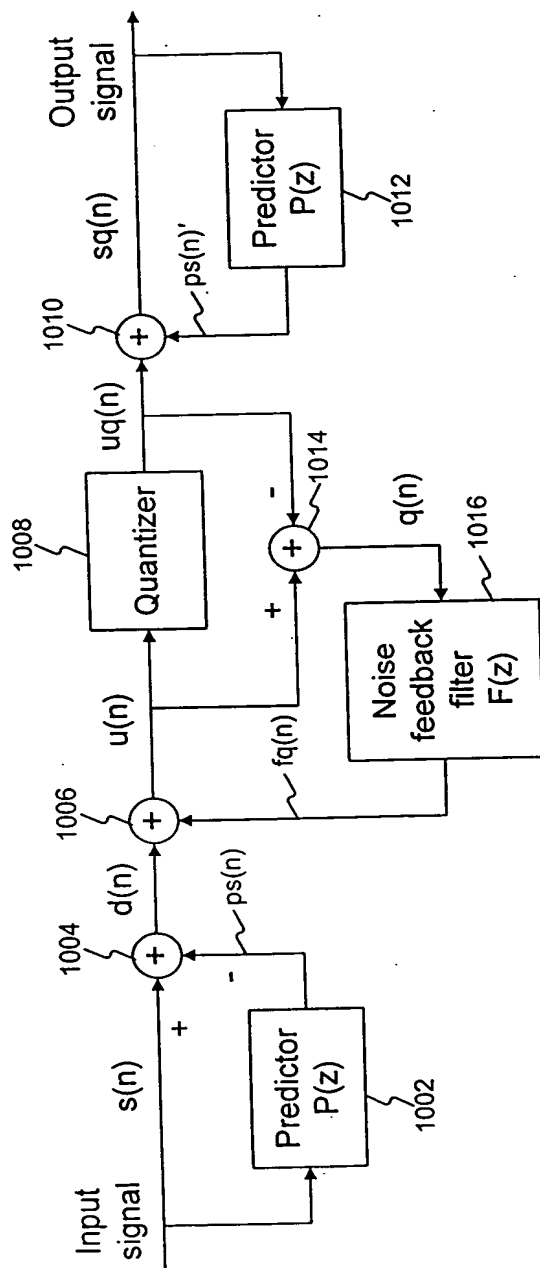


Figure 1 Conventional Noise Feedback Coding

1050

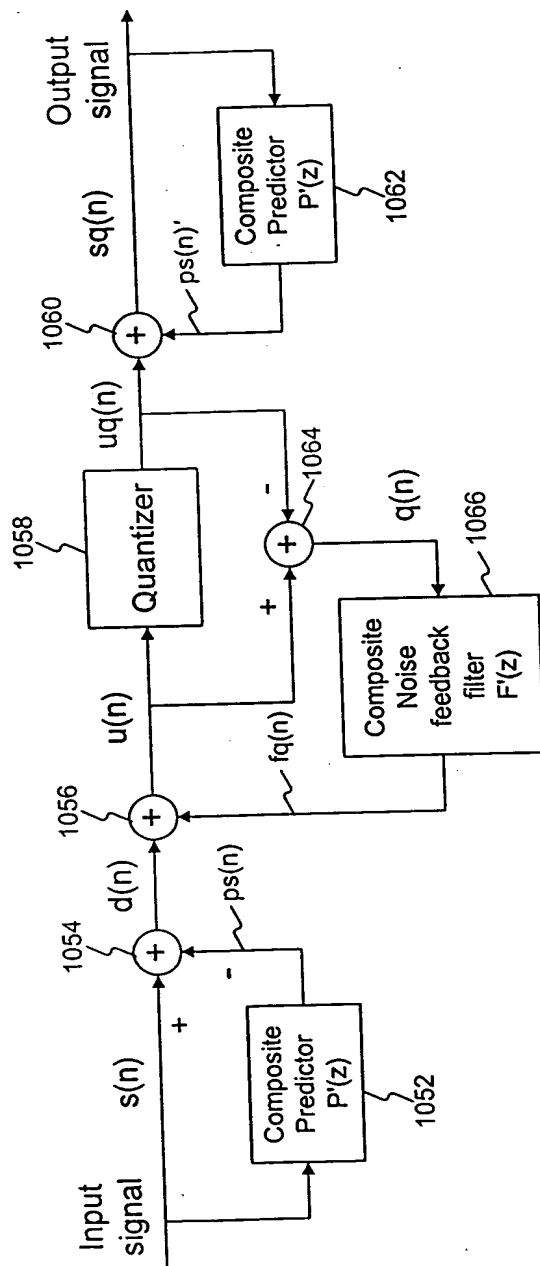


Figure 1A Noise Feedback Coding Using Composite Short-Term and Long-Term Predictors and Composite Short-Term and Long-Term Filter

2000

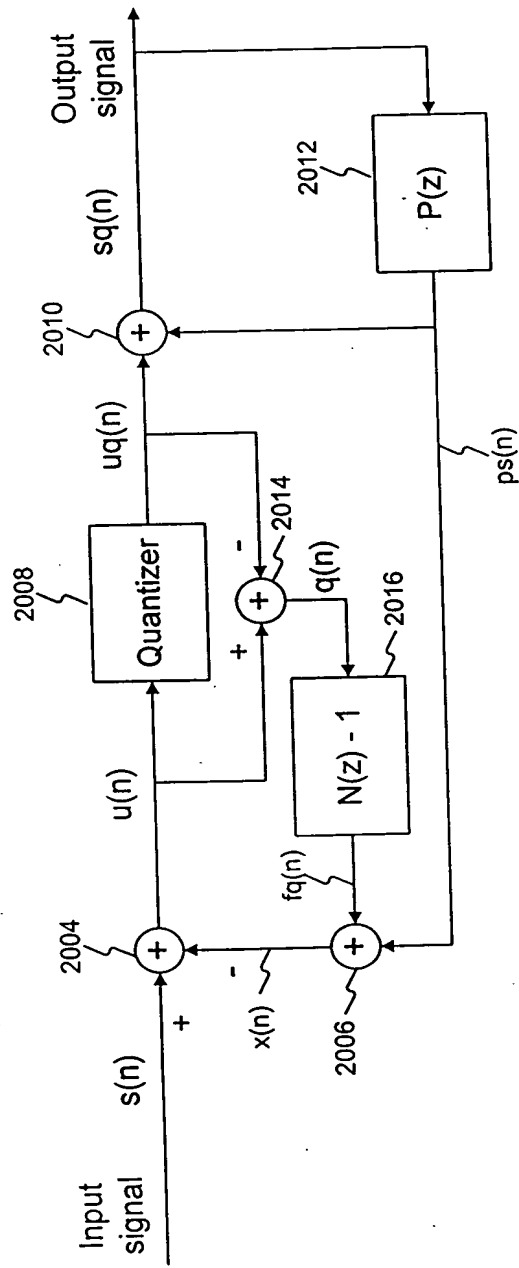


Figure 2 An alternative form of conventional Noise Feedback Coding

2050

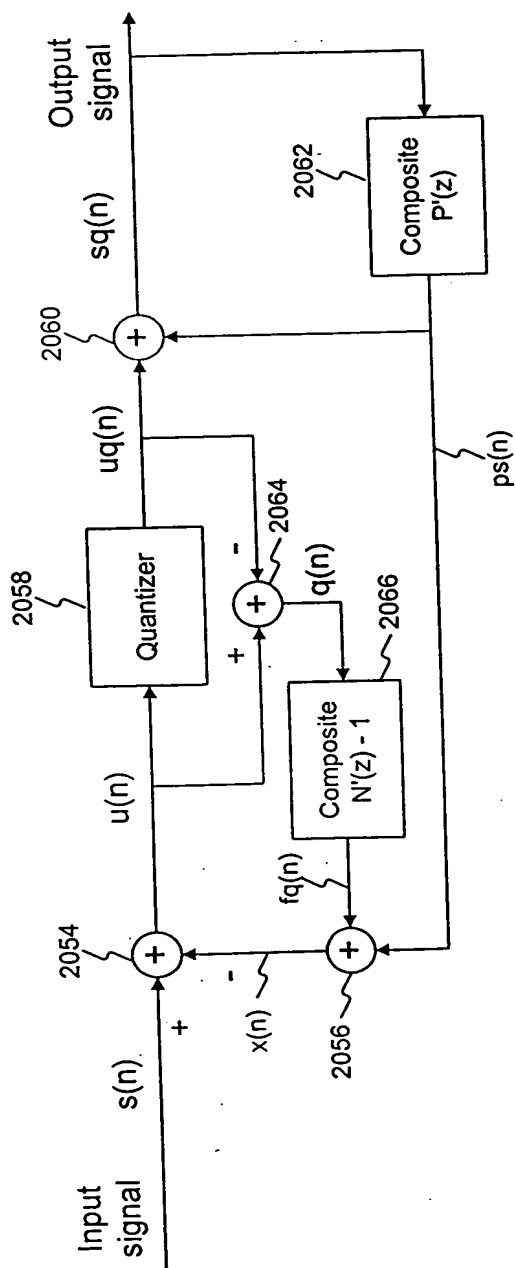


Figure 2A Noise Feedback Coding Using Composite Predictor and Composite Noise Filter

3000

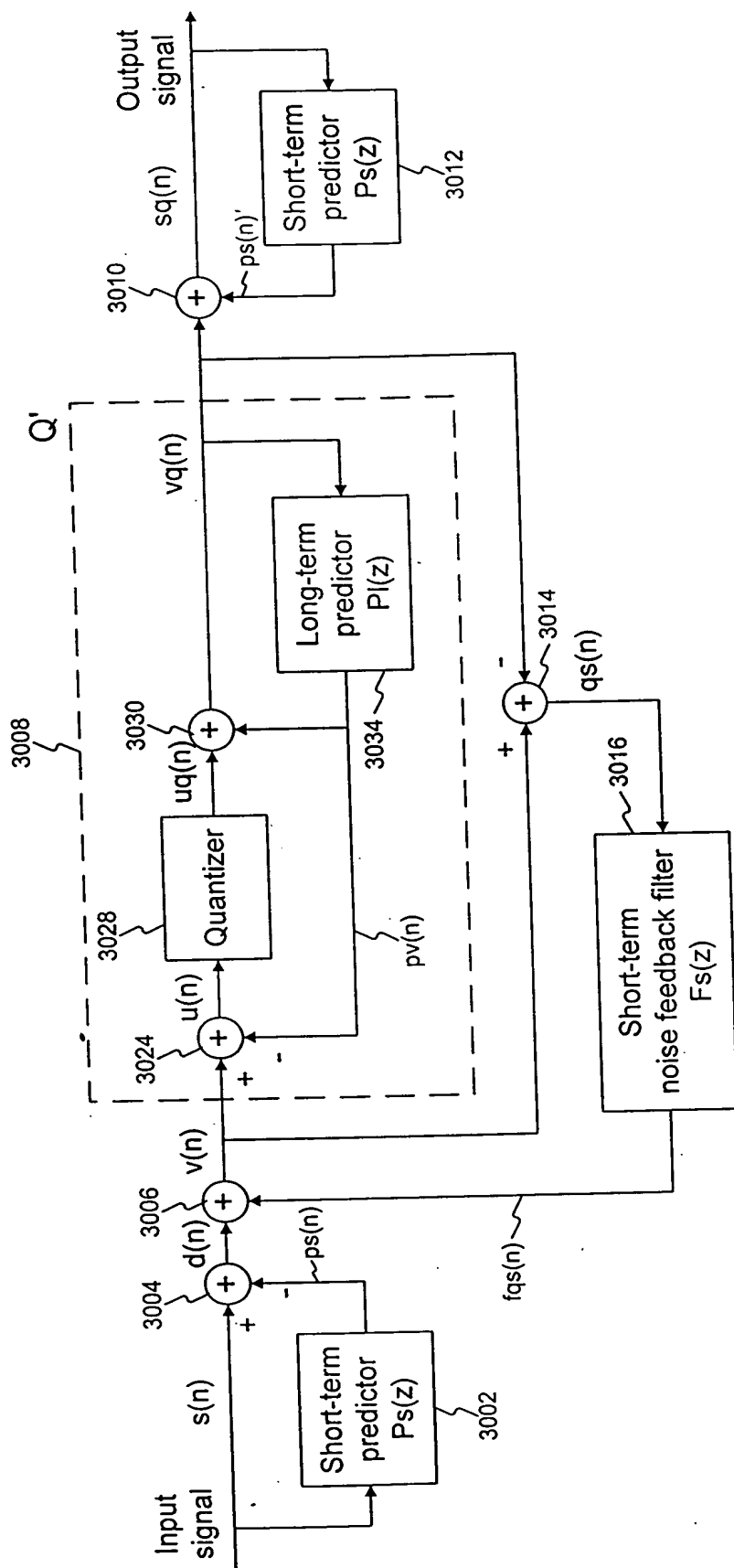


Figure 3 Noise Feedback Coding with short-term and long-term prediction but only short-term noise spectral shaping

4000

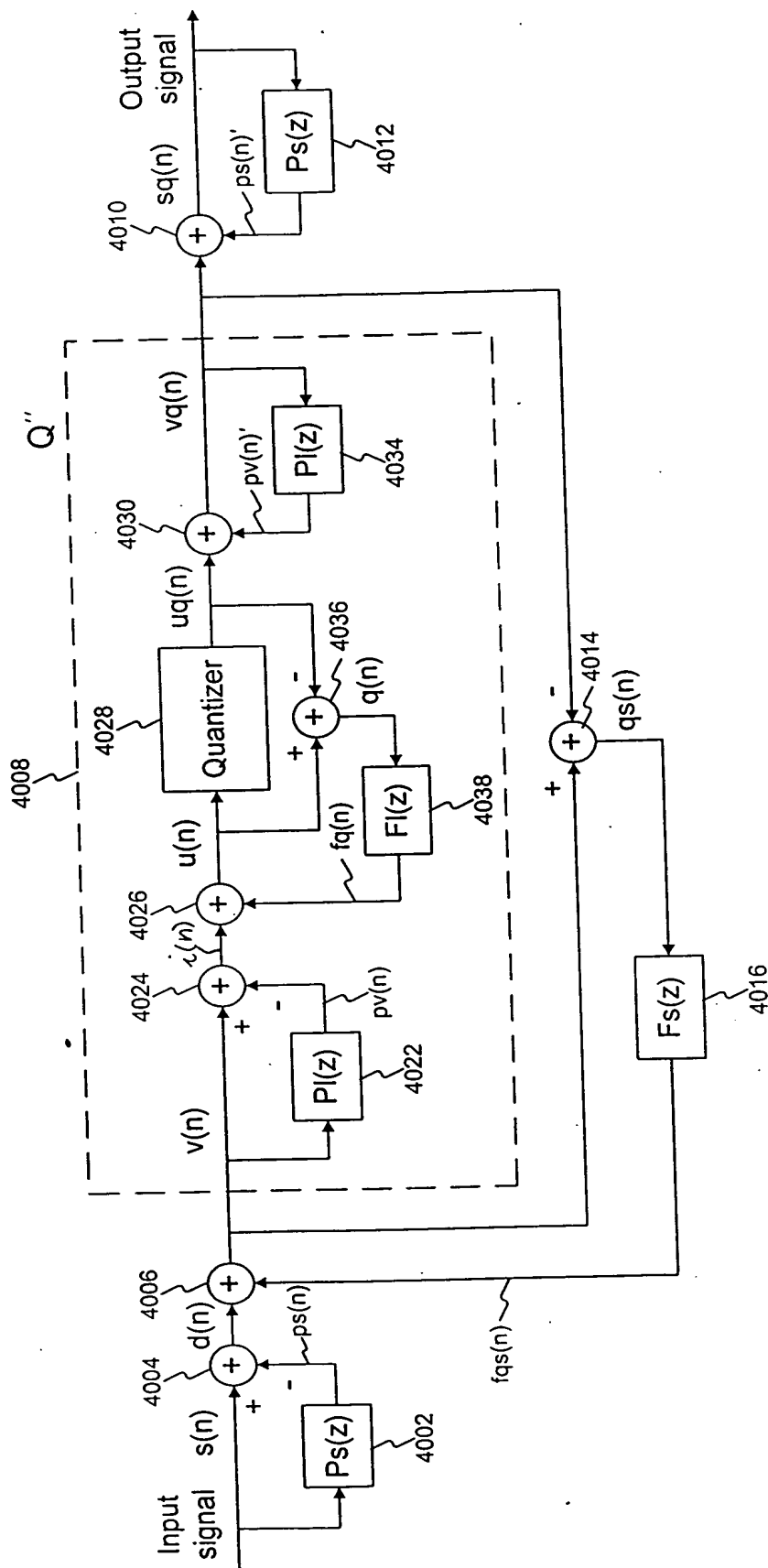


Figure 4 Nested two-stage Noise Feedback Coding structure with short-term and long-term prediction and short-term and long-term noise spectral shaping

5000

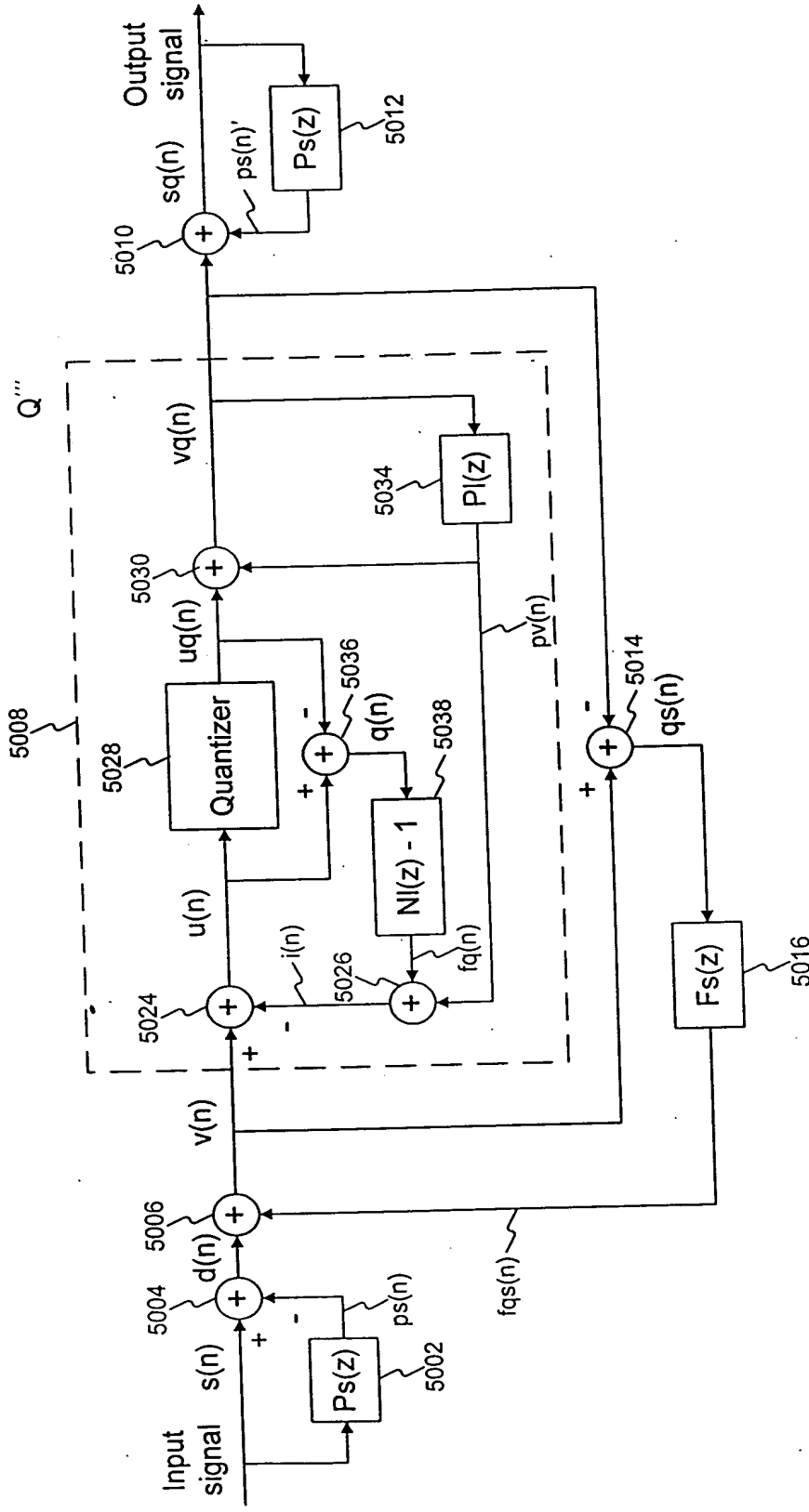


Figure 5 An alternative nested two-stage Noise Feedback Coding structure with short-term and long-term prediction and short-term and long-term noise spectral shaping

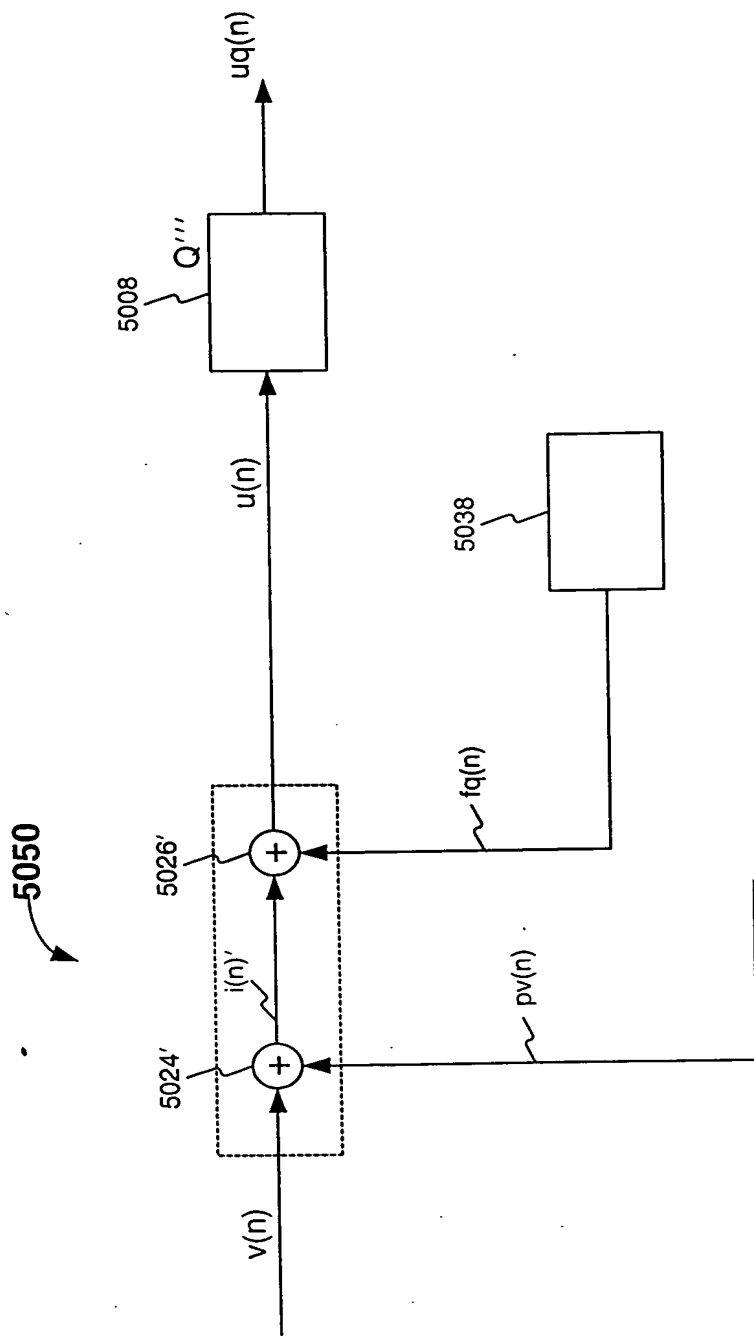


FIG. 5A

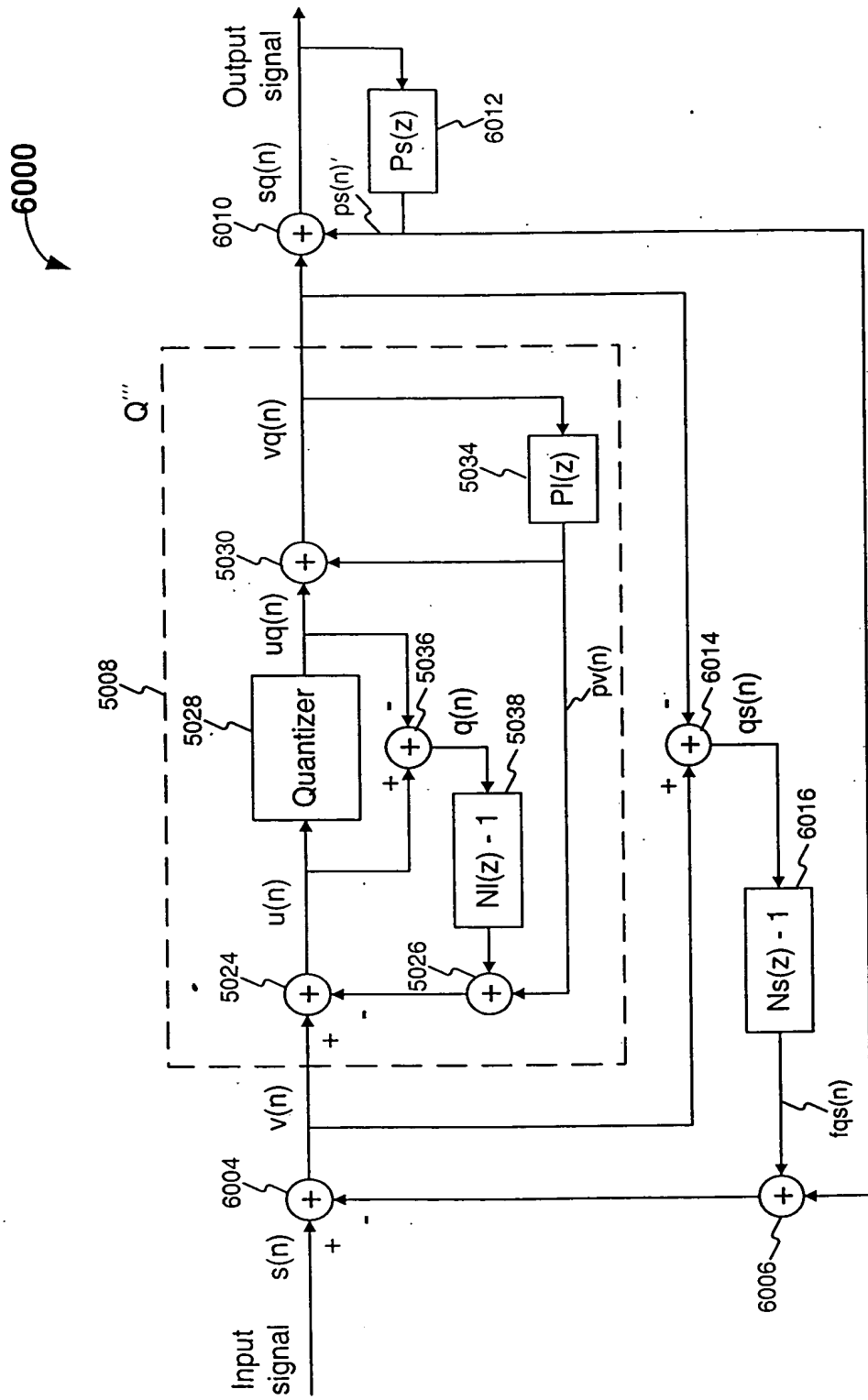


Figure 6 Another alternative nested two-stage Noise Feedback Coding structure with short-term and long-term prediction and short-term and long-term noise spectral shaping

FIG. 6A

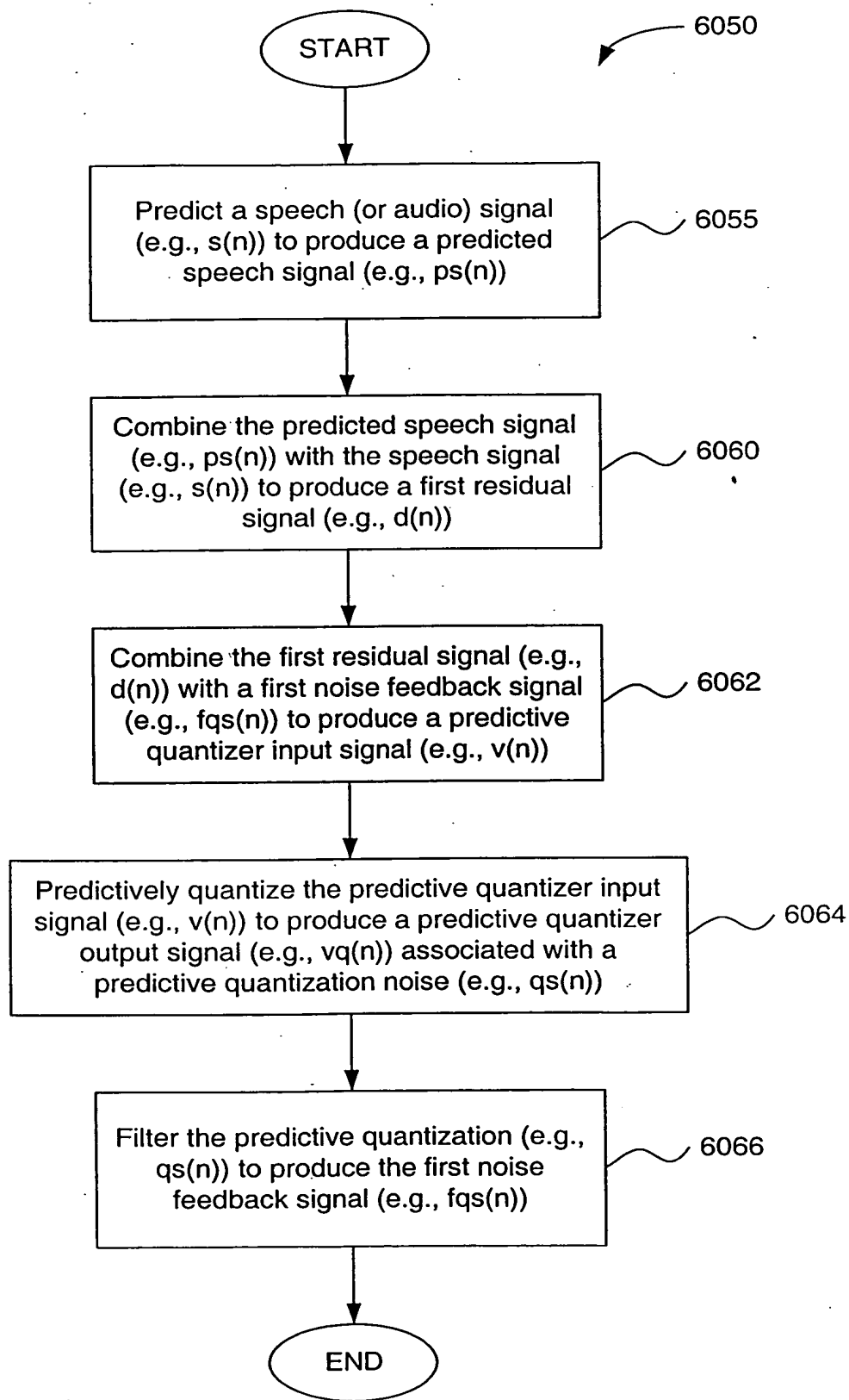


FIG. 6A

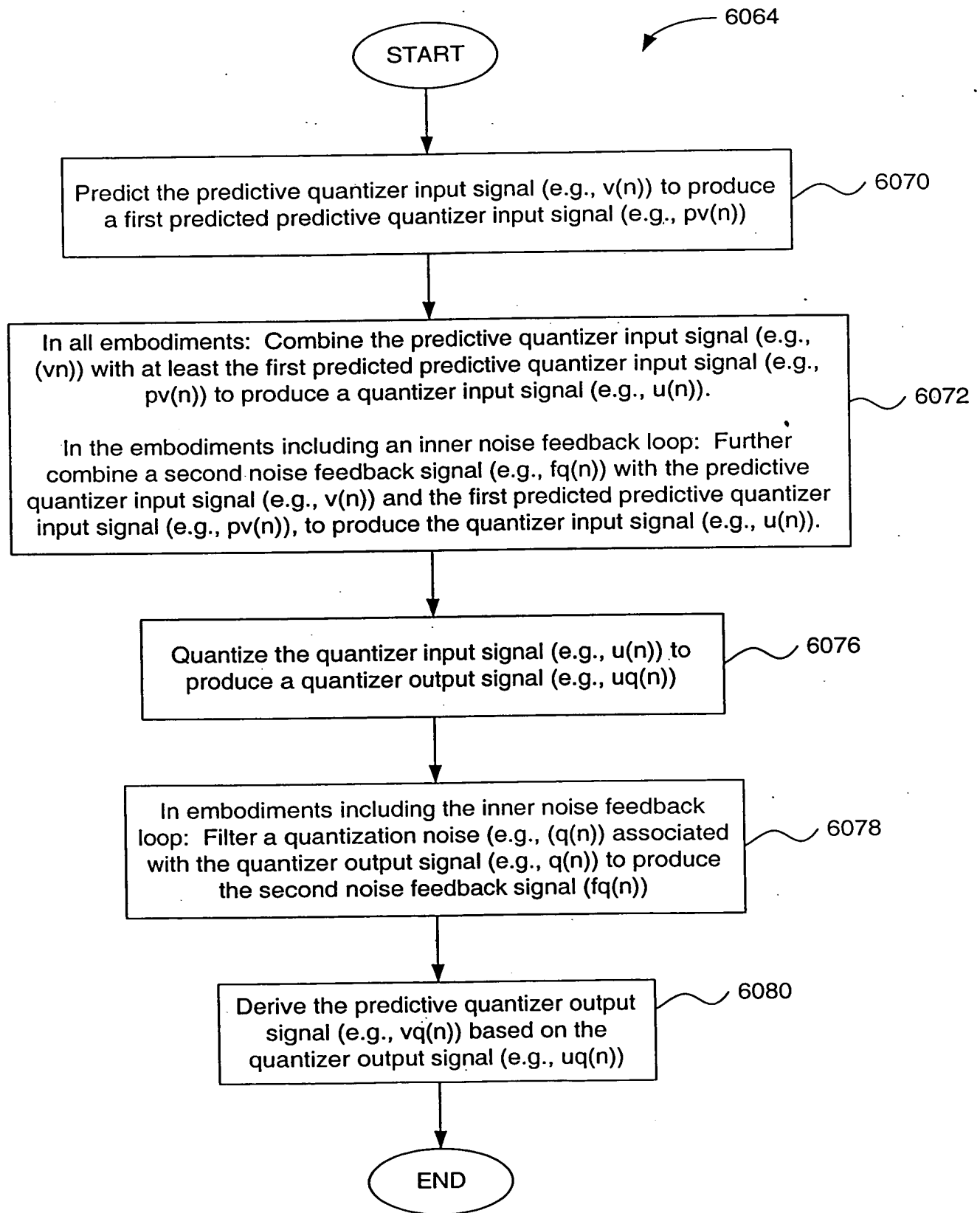


FIG. 6B

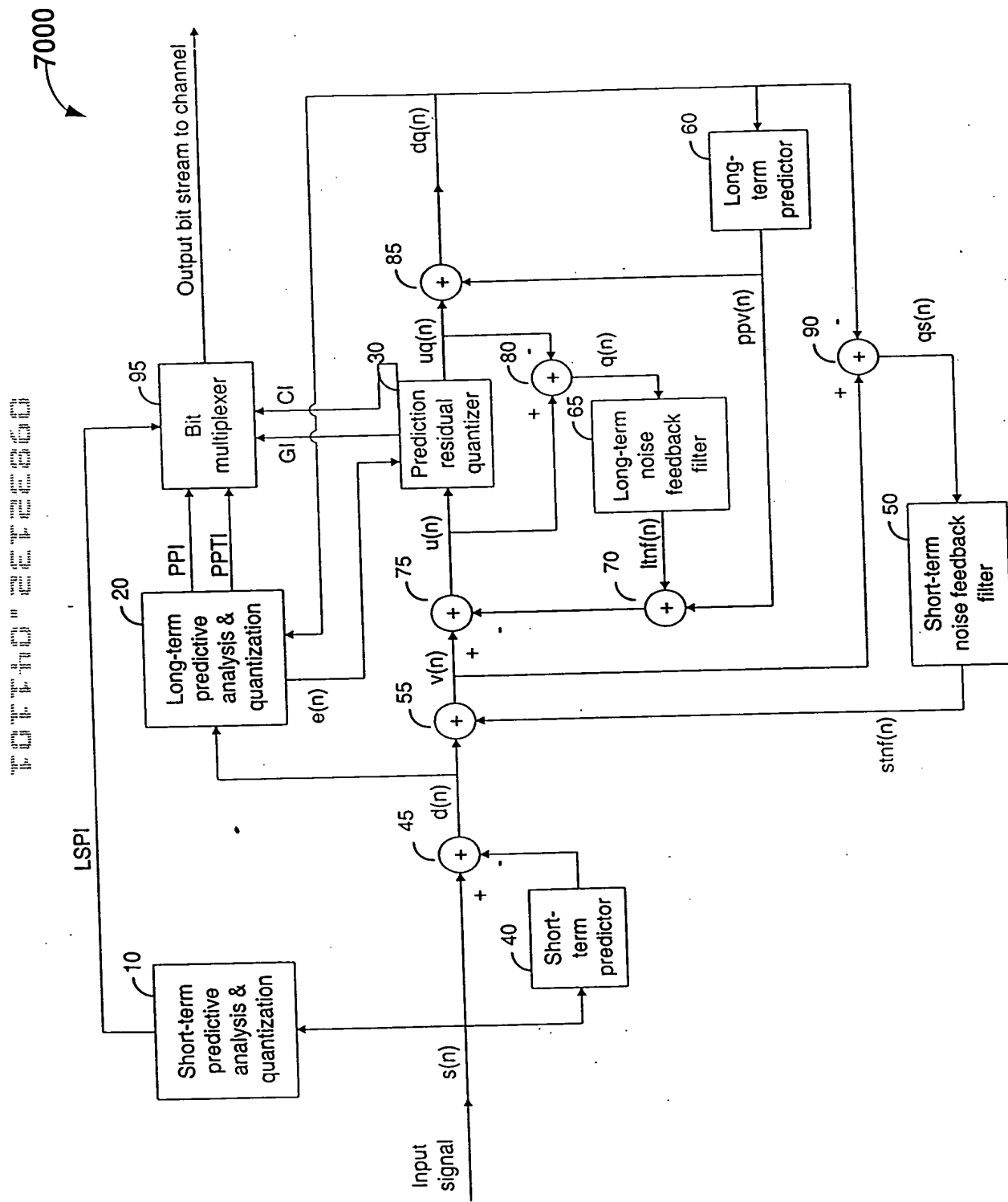


Figure 7 Encoder of a nested two-stage noise feedback codec (TSNFC)

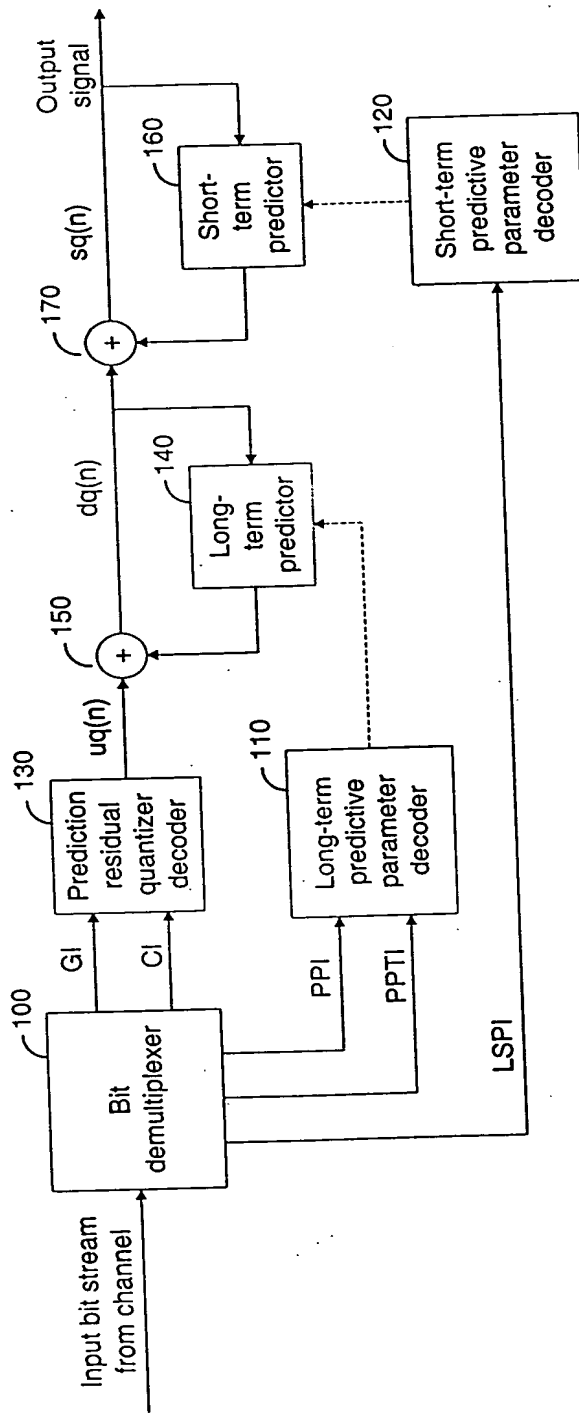


Figure 8 Decoder corresponding to the TSNFC encoder in Fig. 7

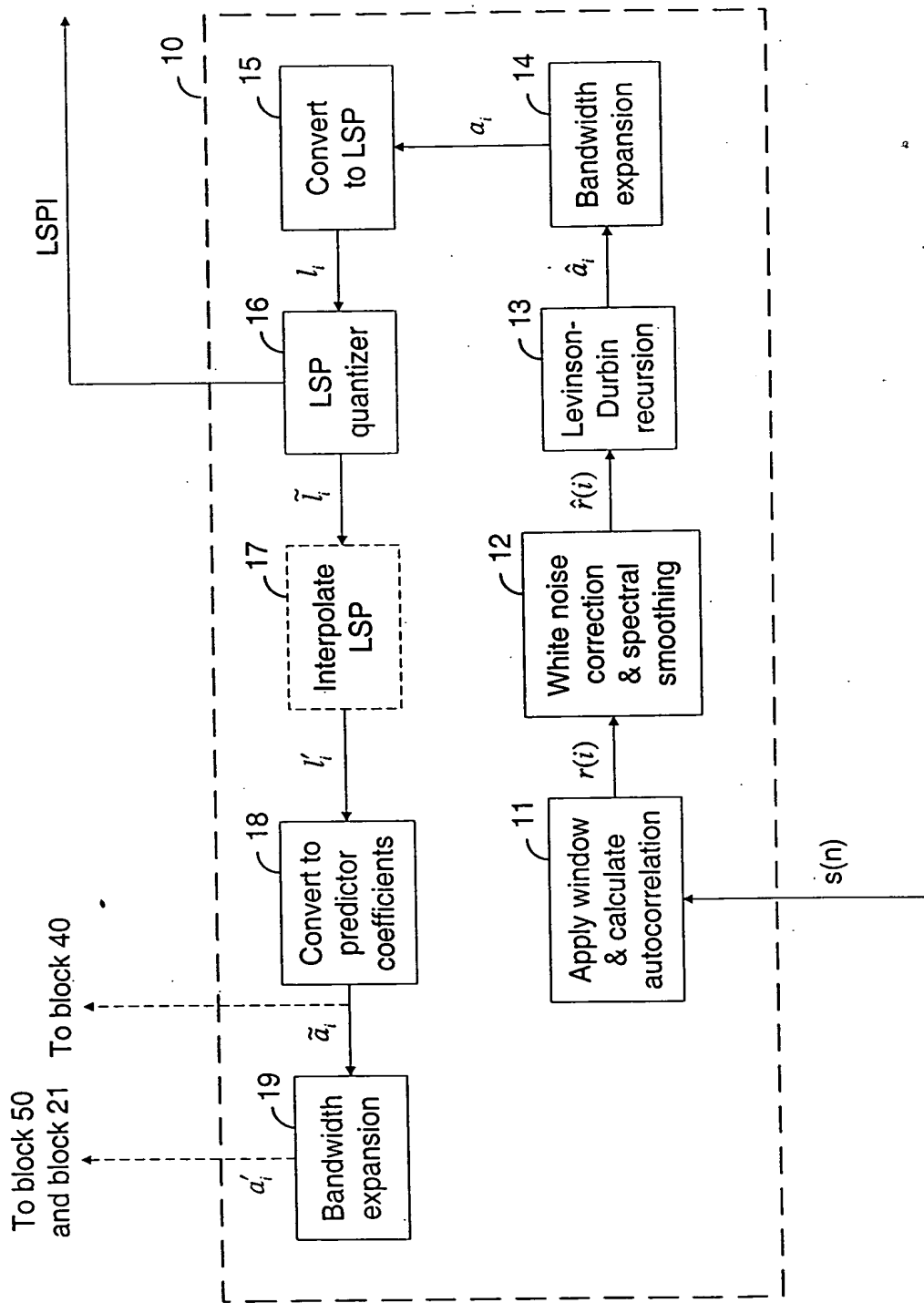


Figure 9 Short-term predictive analysis and quantization (block 10)

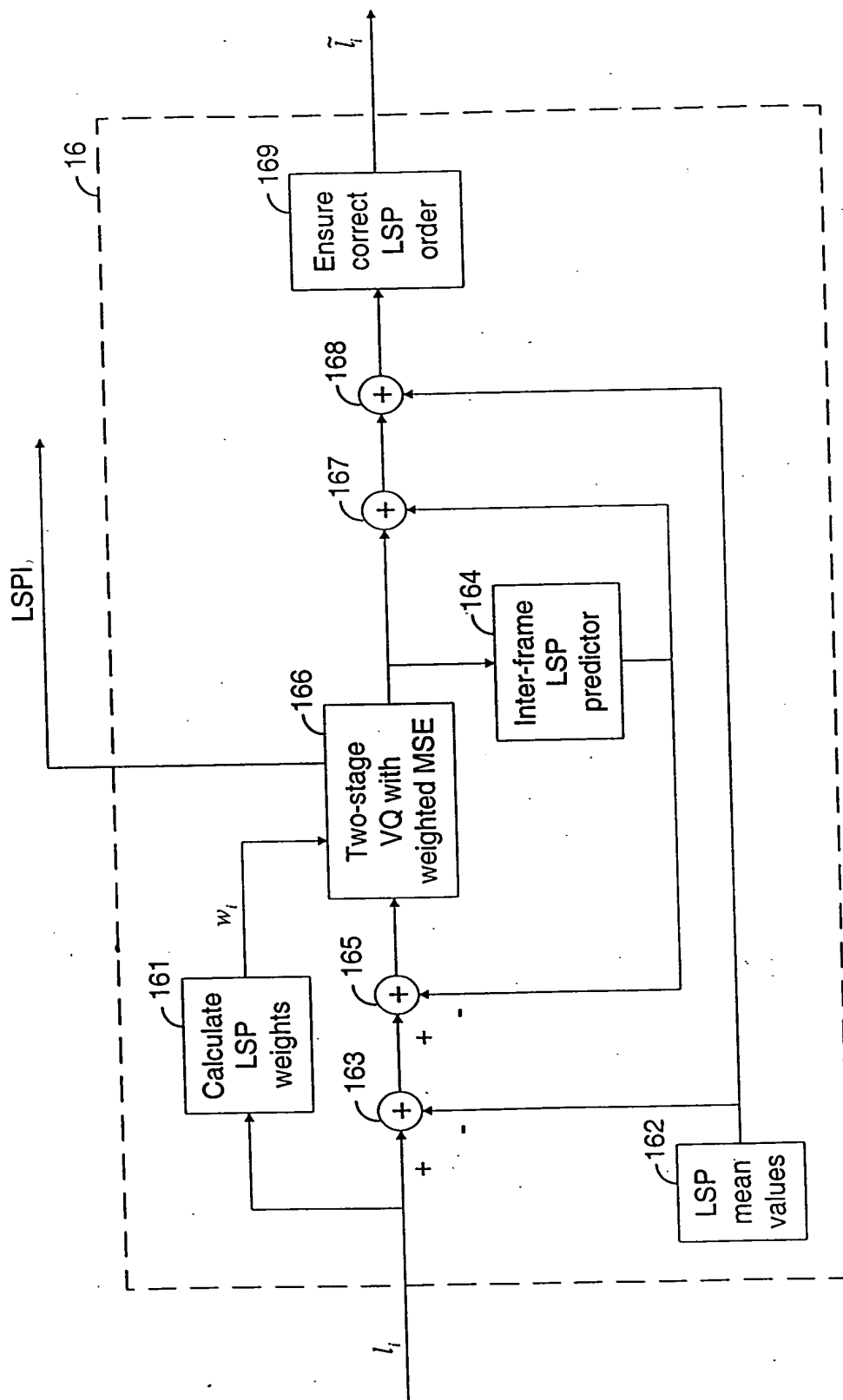
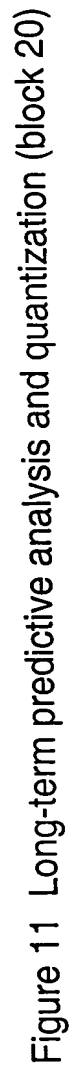


Figure 10 LSP quantizer (block 16)



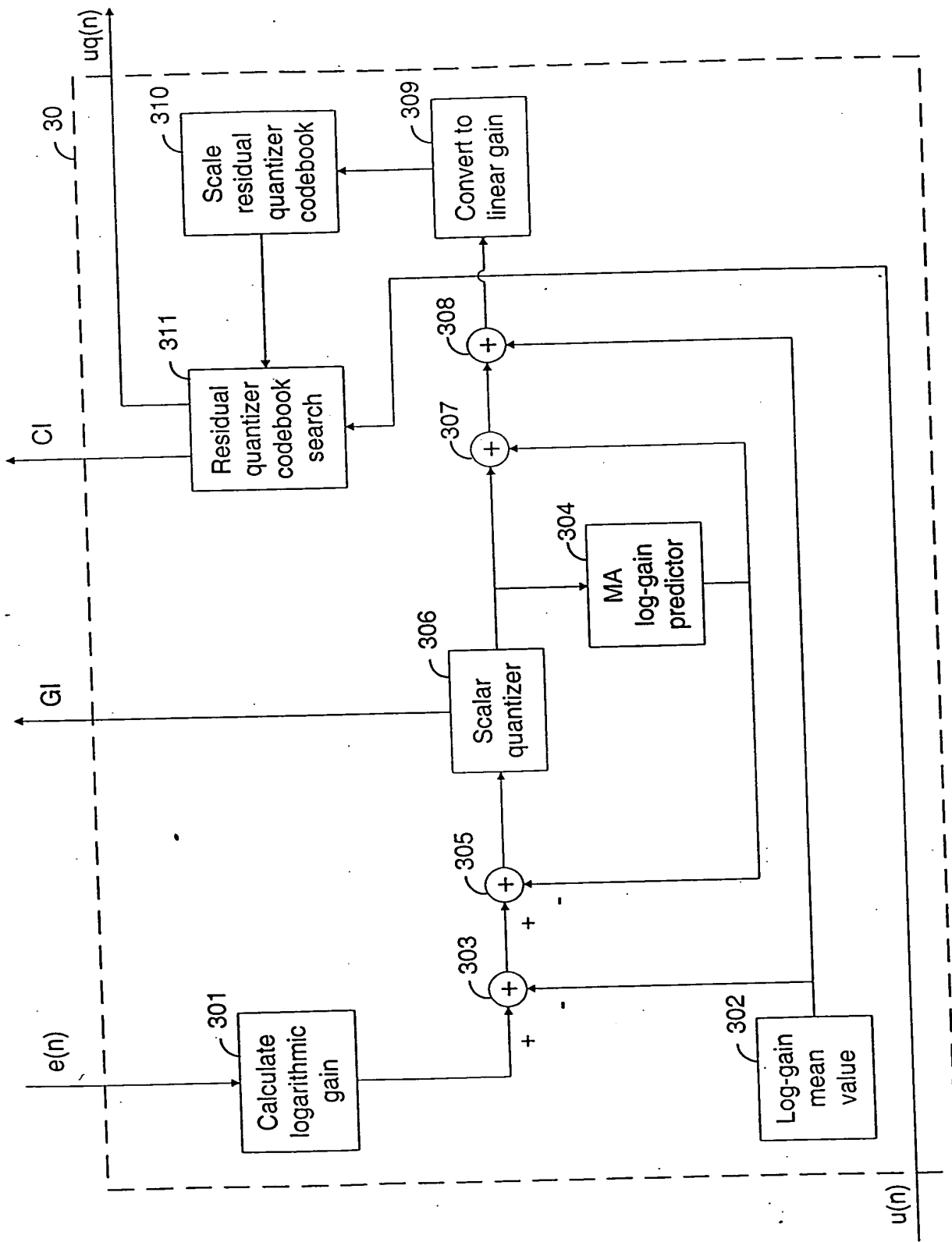


Figure 12 Prediction residual quantizer (block 30)

1300

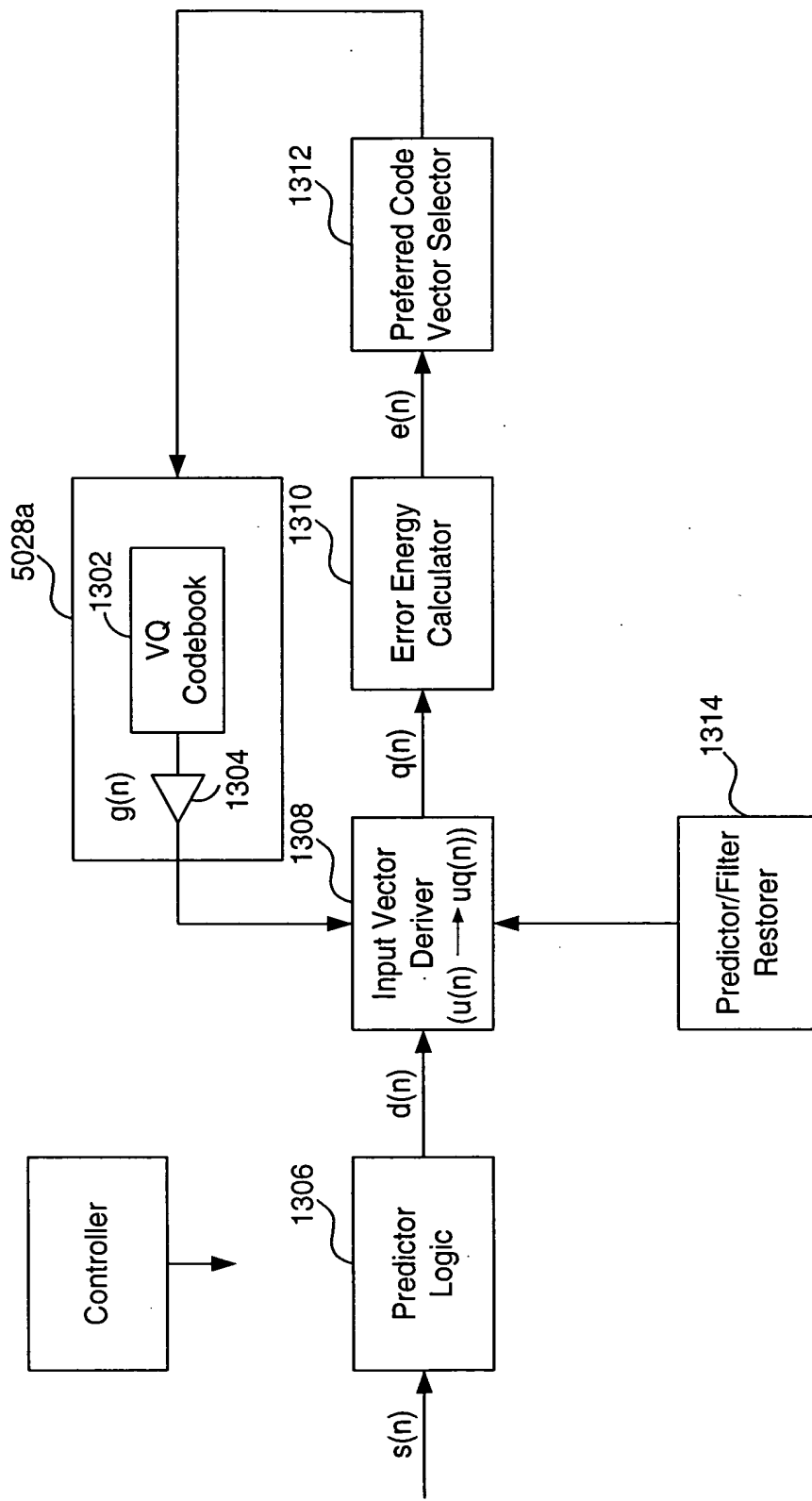


FIG. 13A

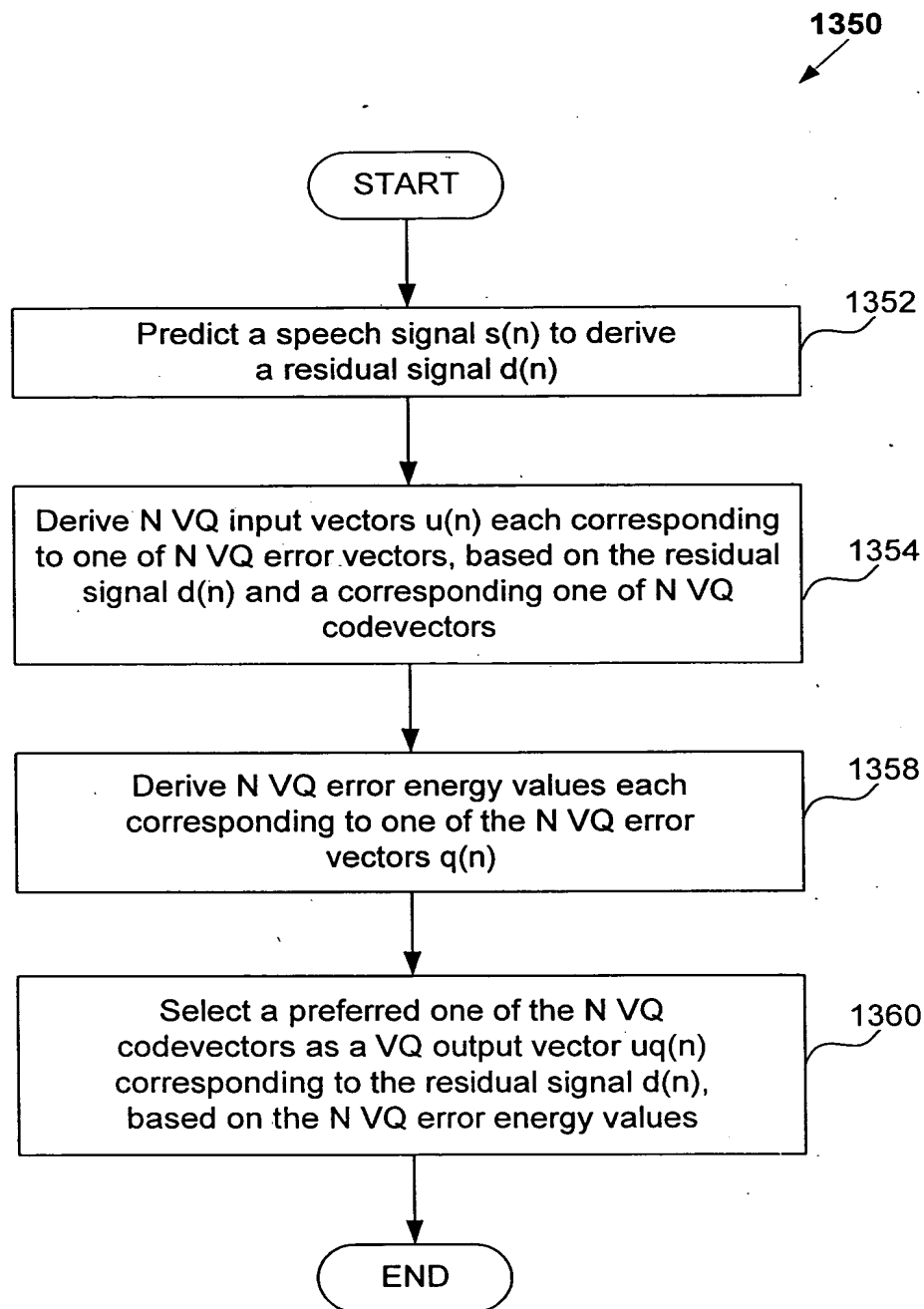
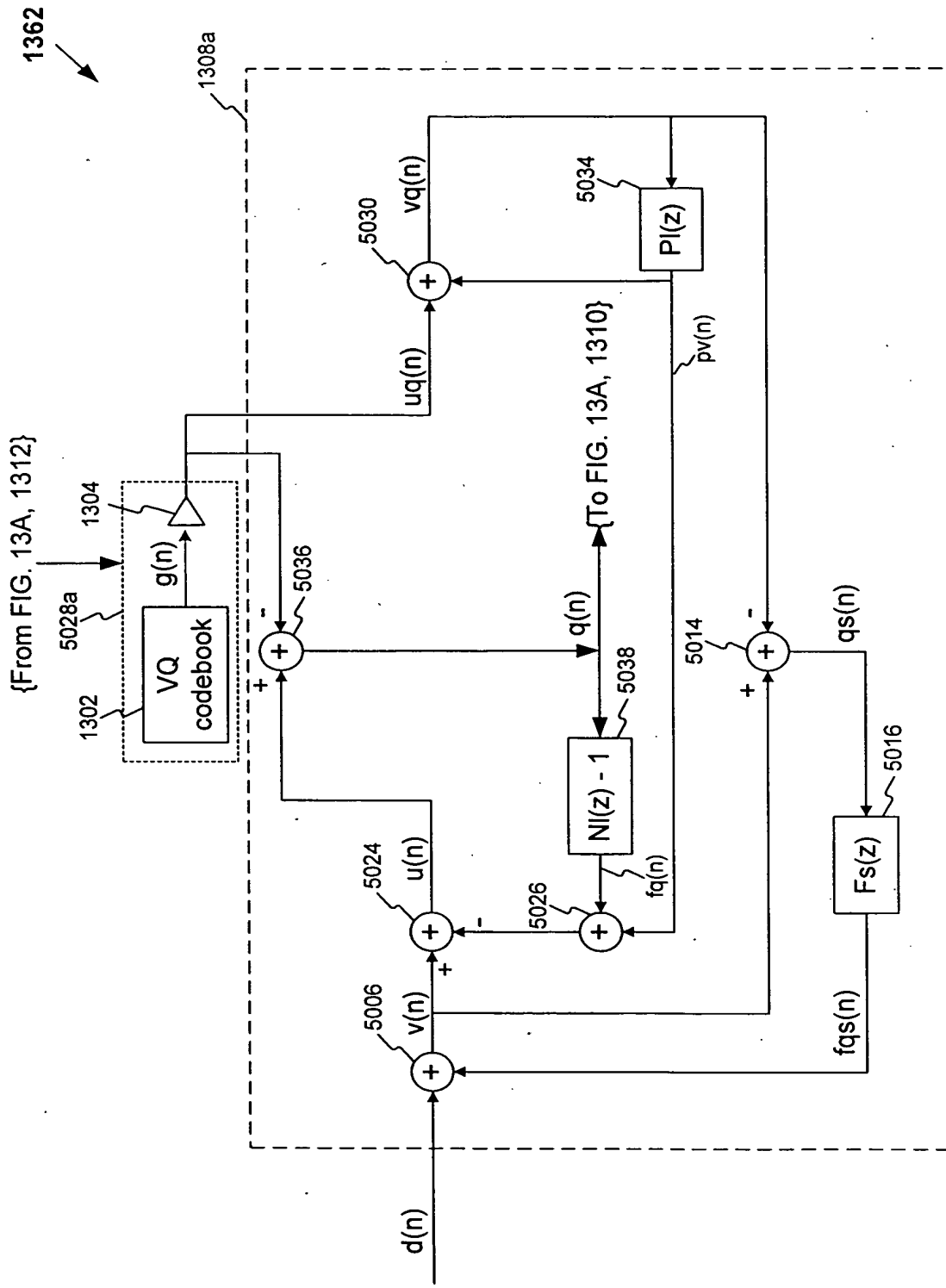


FIG. 13B



The portion of the codec structure that is used in prediction residual VQ codebook search of the two-stage noise feedback codec of Fig. 5.

FIG. 13C

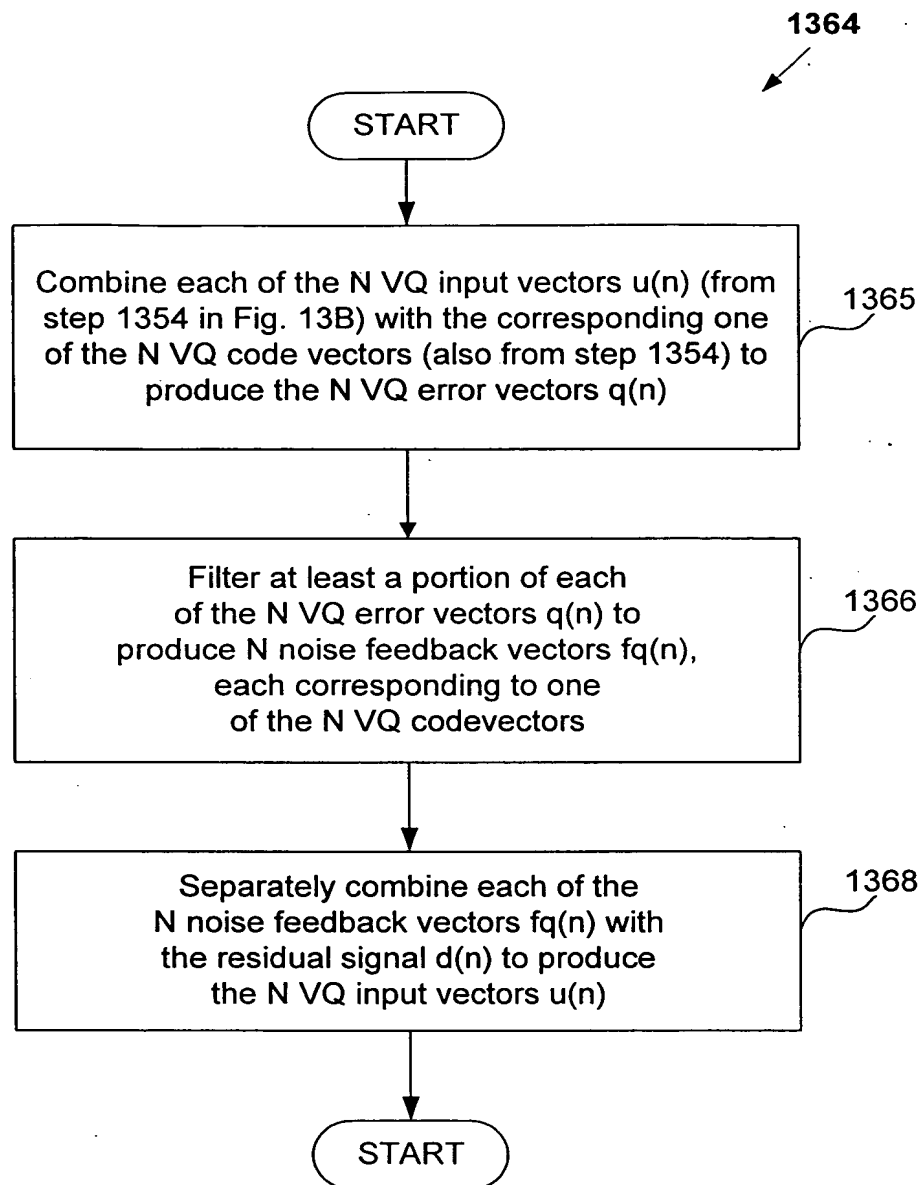


FIG. 13D

1370

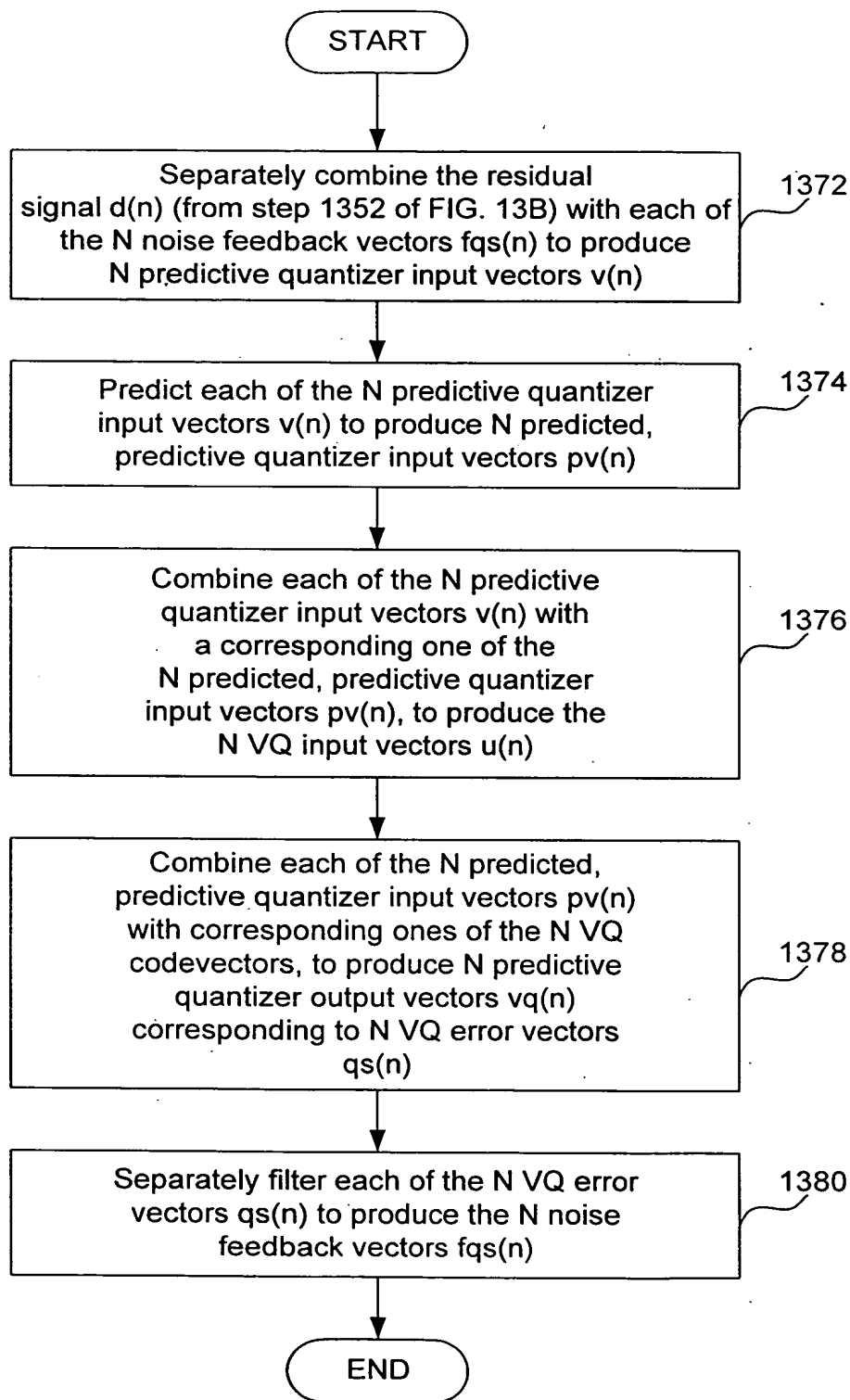


FIG. 13E

1400

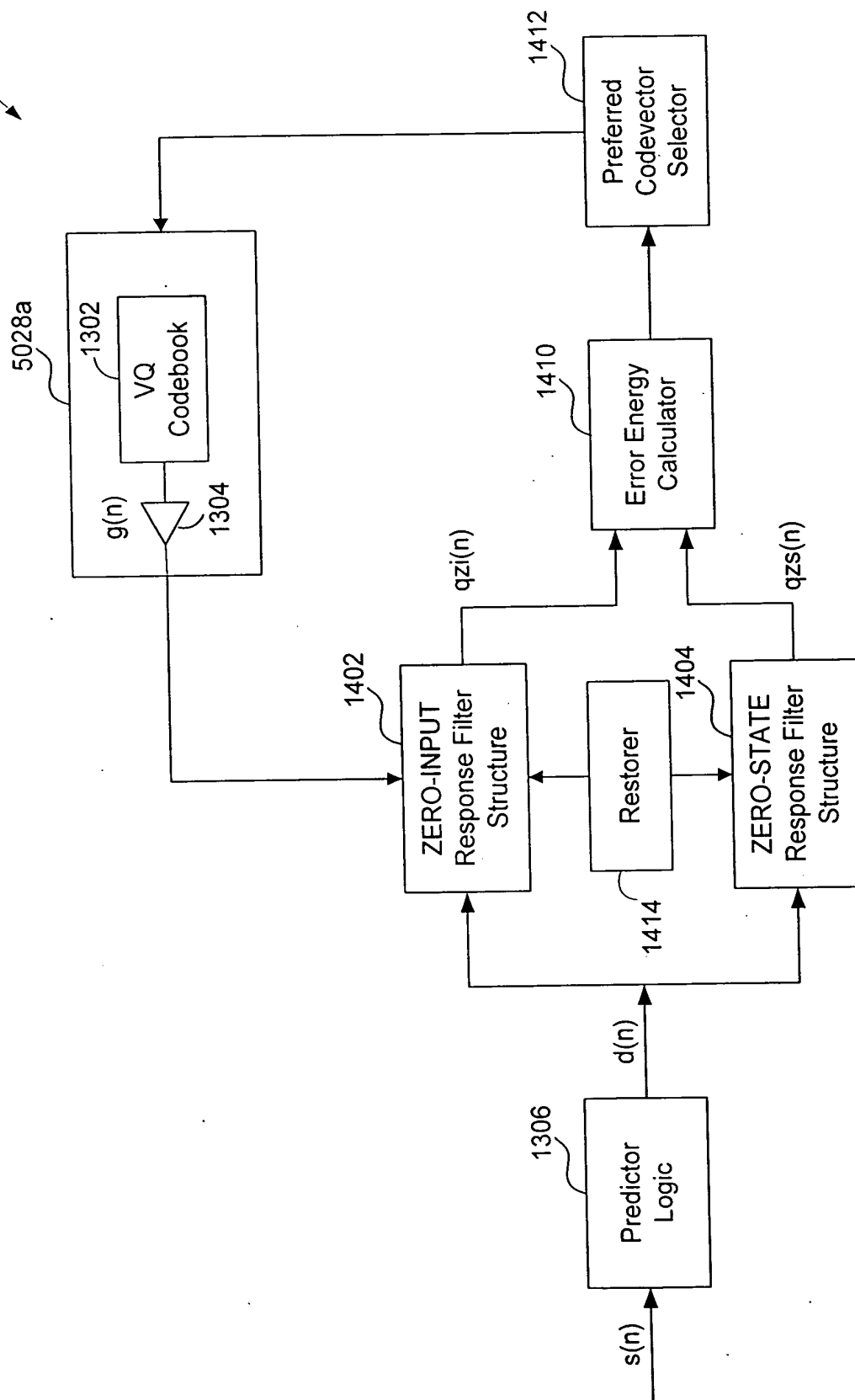


FIG. 14A

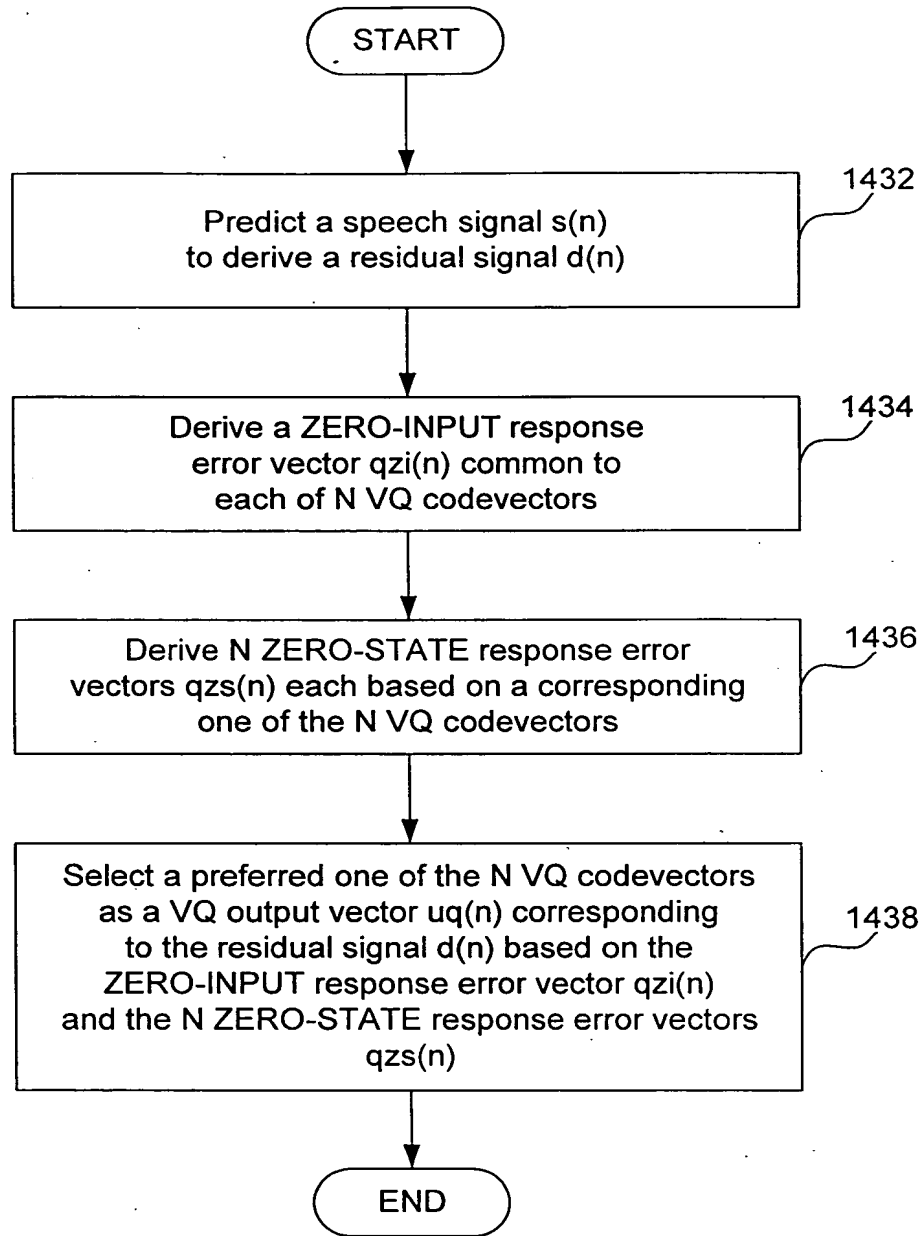
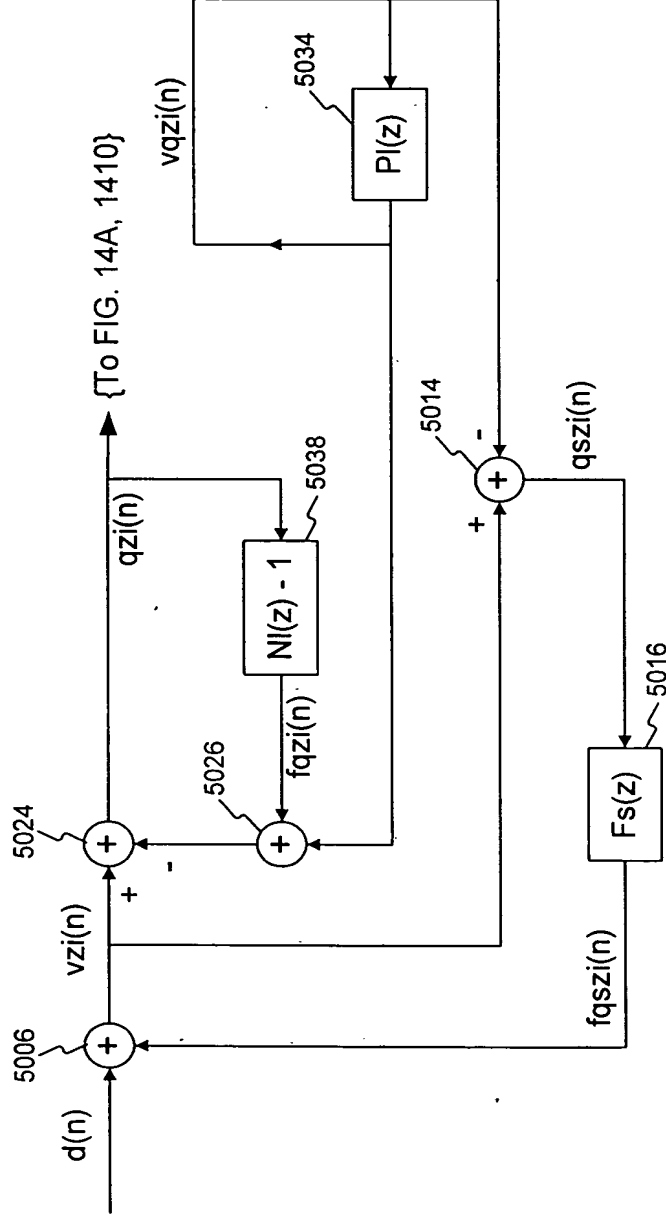


FIG. 14B

1402a



Filter structure during the calculation of the zero-input response of $q(n)$ of Fig. 13C.

FIG. 14C

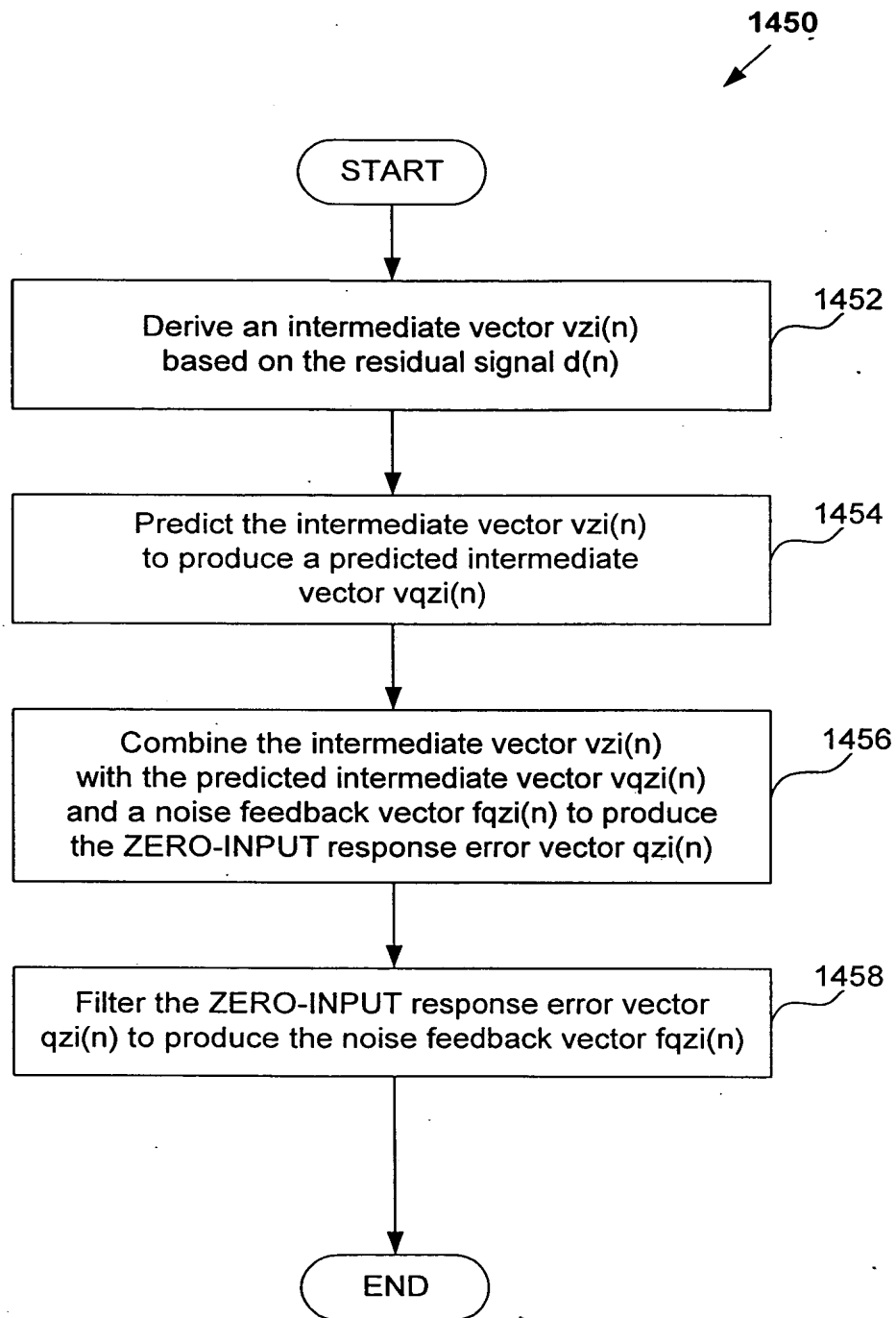


FIG. 14D

1470

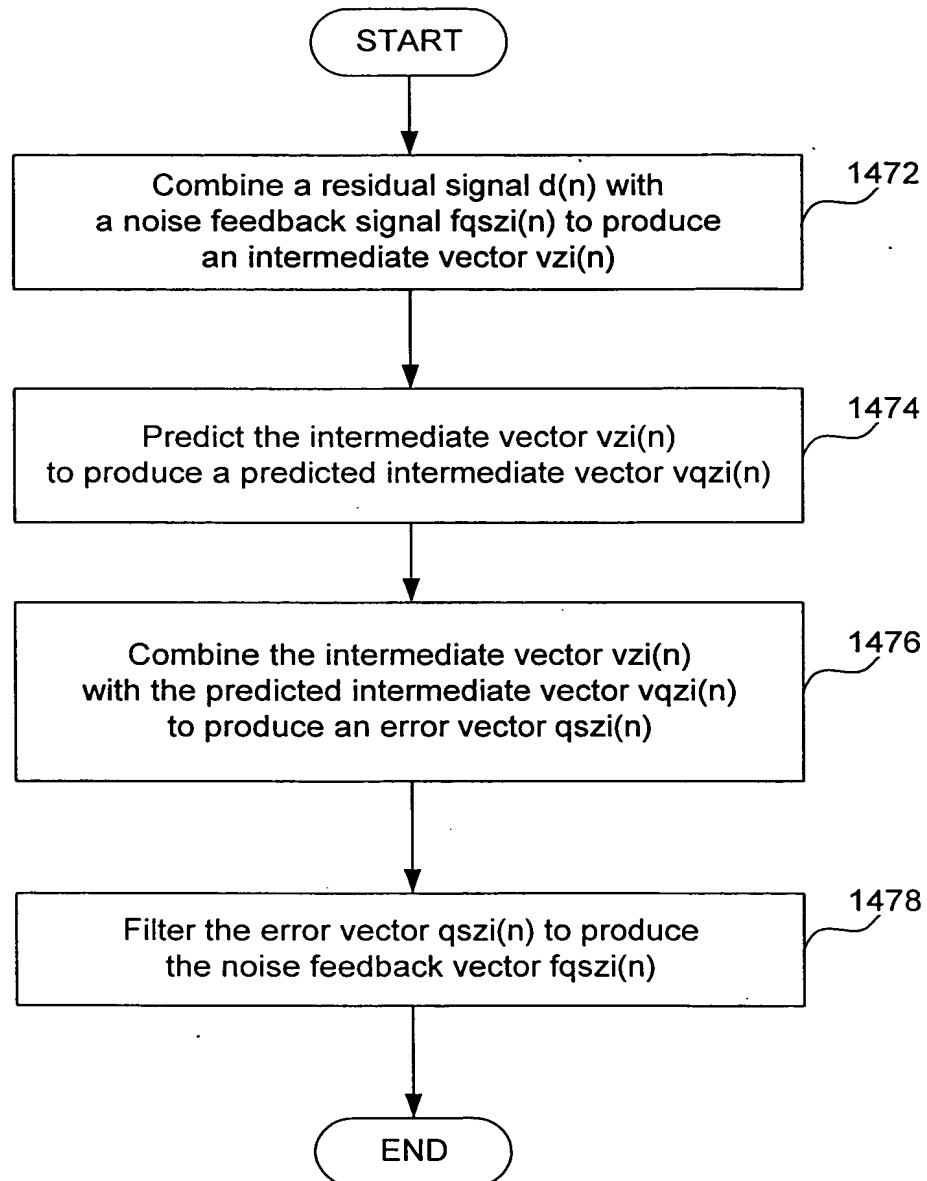
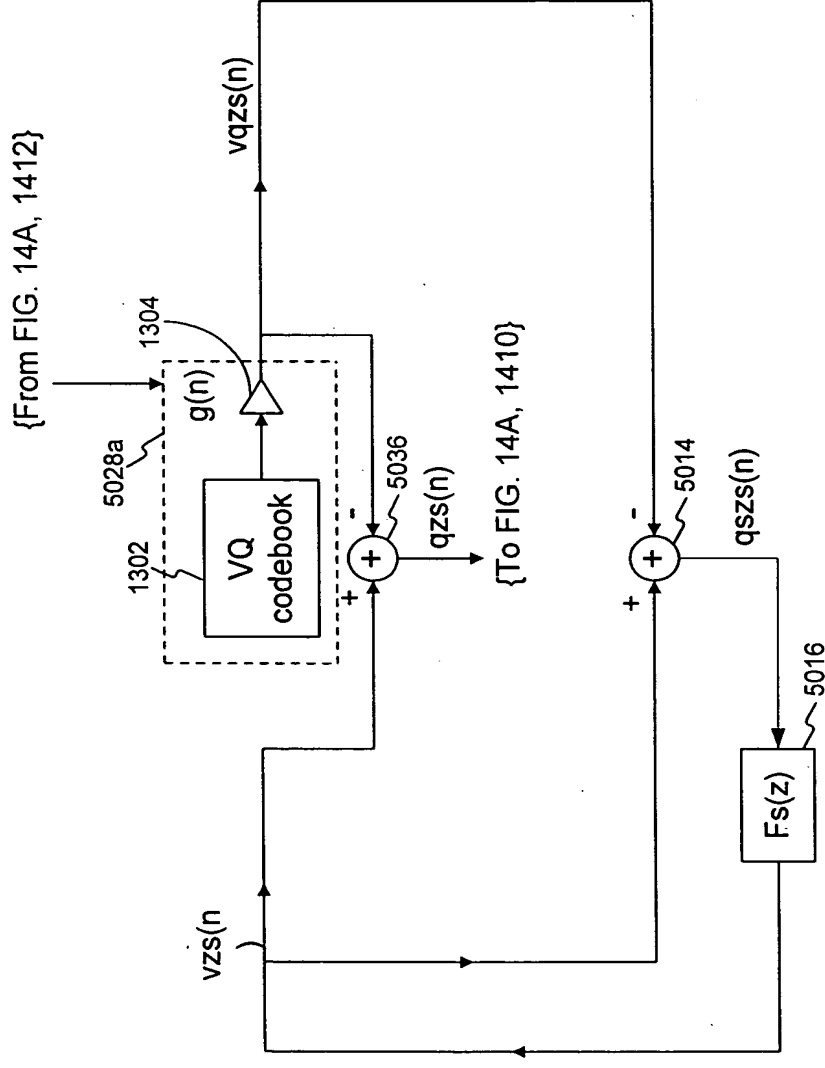


FIG. 14E

1404a



Filter structure during the calculation of the zero-state response of $q(n)$ in Fig. 13C.

FIG. 15A

START

Filter an error vector $qs_zs(n)$ associated with each of the N VQ codevectors to produce a ZERO-STATE input vector $vzs(n)$ corresponding to each of the N VQ codevectors

1522

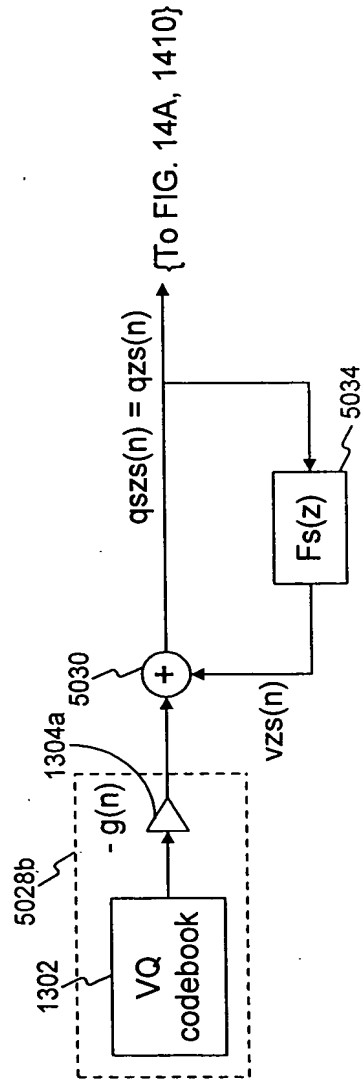
Separately combine each ZERO-STATE input vector $vzs(n)$ produced by the filter with the corresponding one of the N VQ codevectors, to produce the N ZERO-STATE response error vectors $qs_zs(n)$

1524

START

FIG. 15B

1404b



A filter structure equivalent to the structure in Fig. 15A.

FIG. 16A

1620

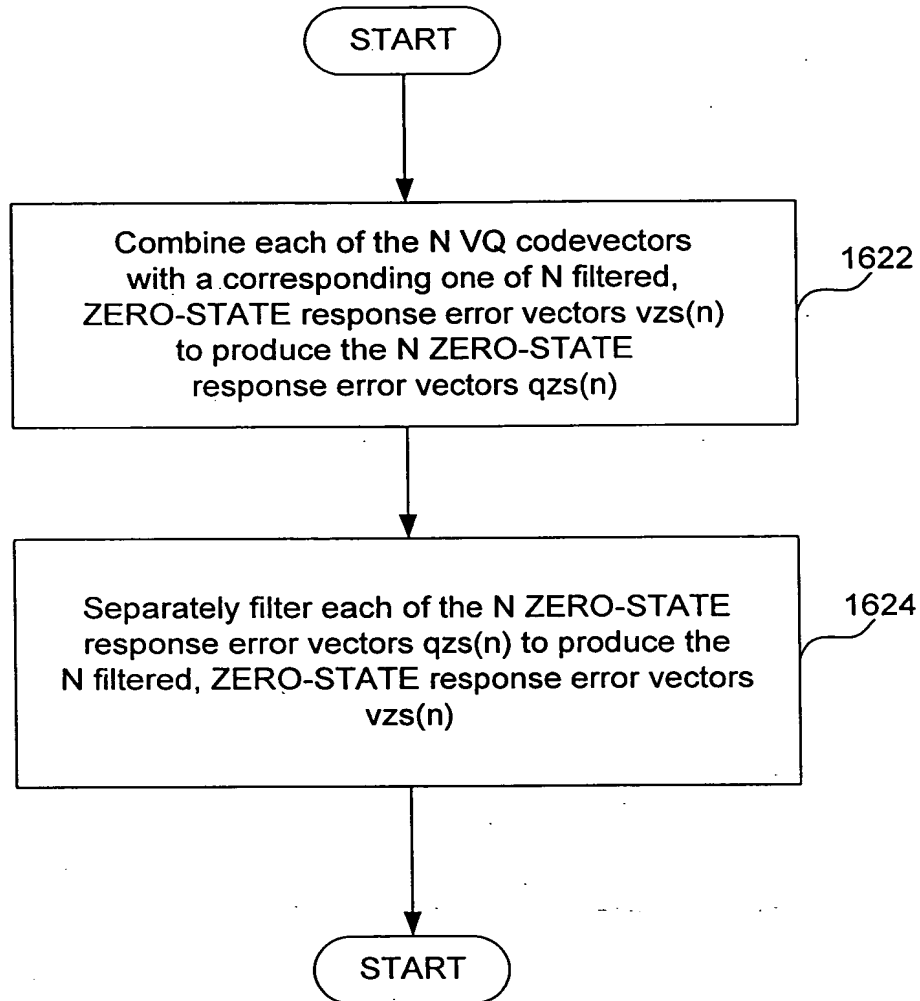


FIG. 16B

START

Receive a speech signal comprising a sequence of speech vectors, each of the speech vectors including a plurality of speech samples

1702

Derive a gain value based on the speech signal once every M speech vectors, where M is greater than one

1704

Derive/update filter parameters based on the speech signal once every T speech vectors

1706

Derive the N ZERO-STATE response error vectors $qzs(n)$ only once every T and/or M speech vectors (i.e., when the filter parameters and/or gain values are updated), whereby a same set of N ZERO-STATE response error vectors $qzs(n)$ is used in selecting T and/or M preferred codevectors corresponding to the T and/or M speech vectors.

1708

END

FIG. 17

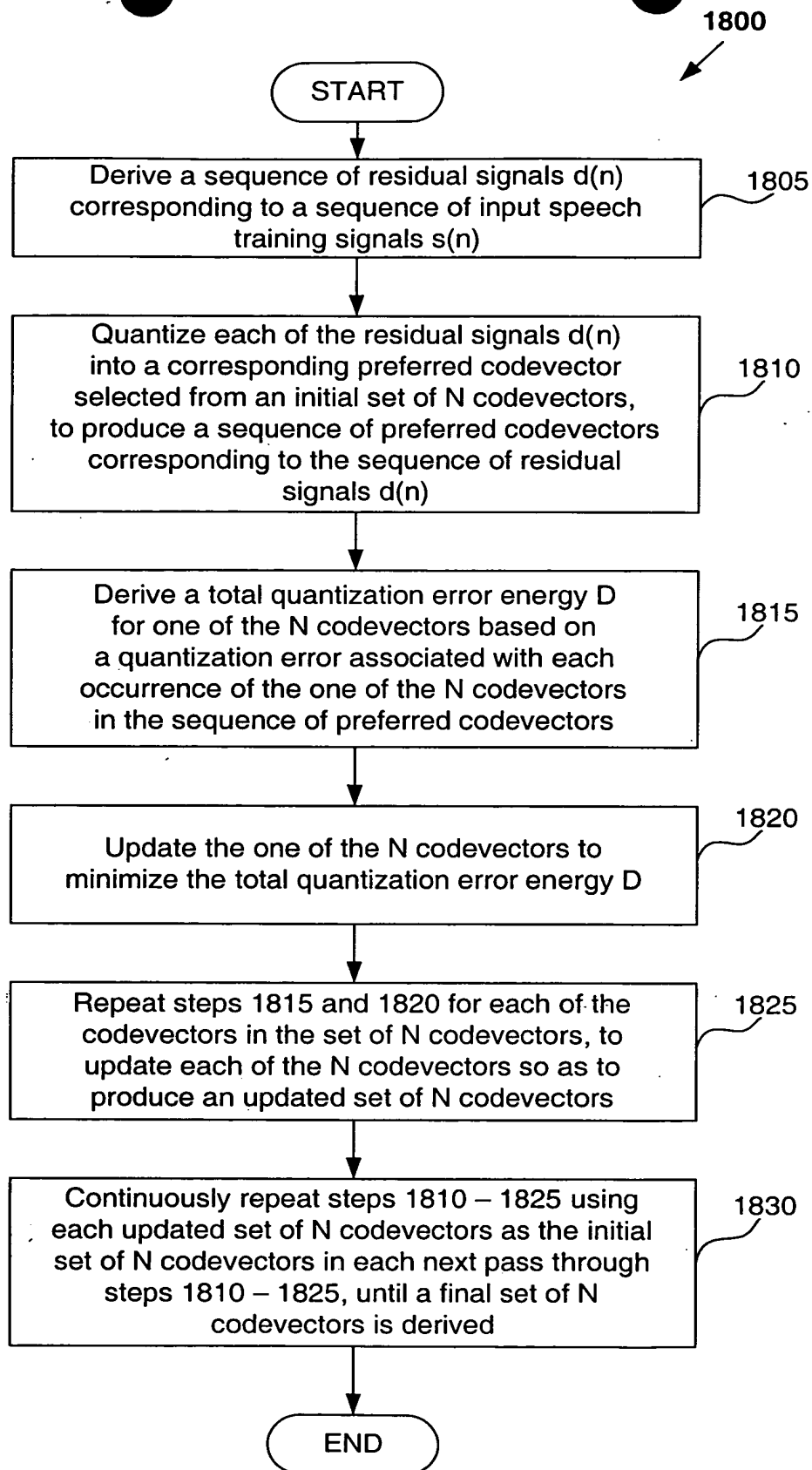


FIG. 18

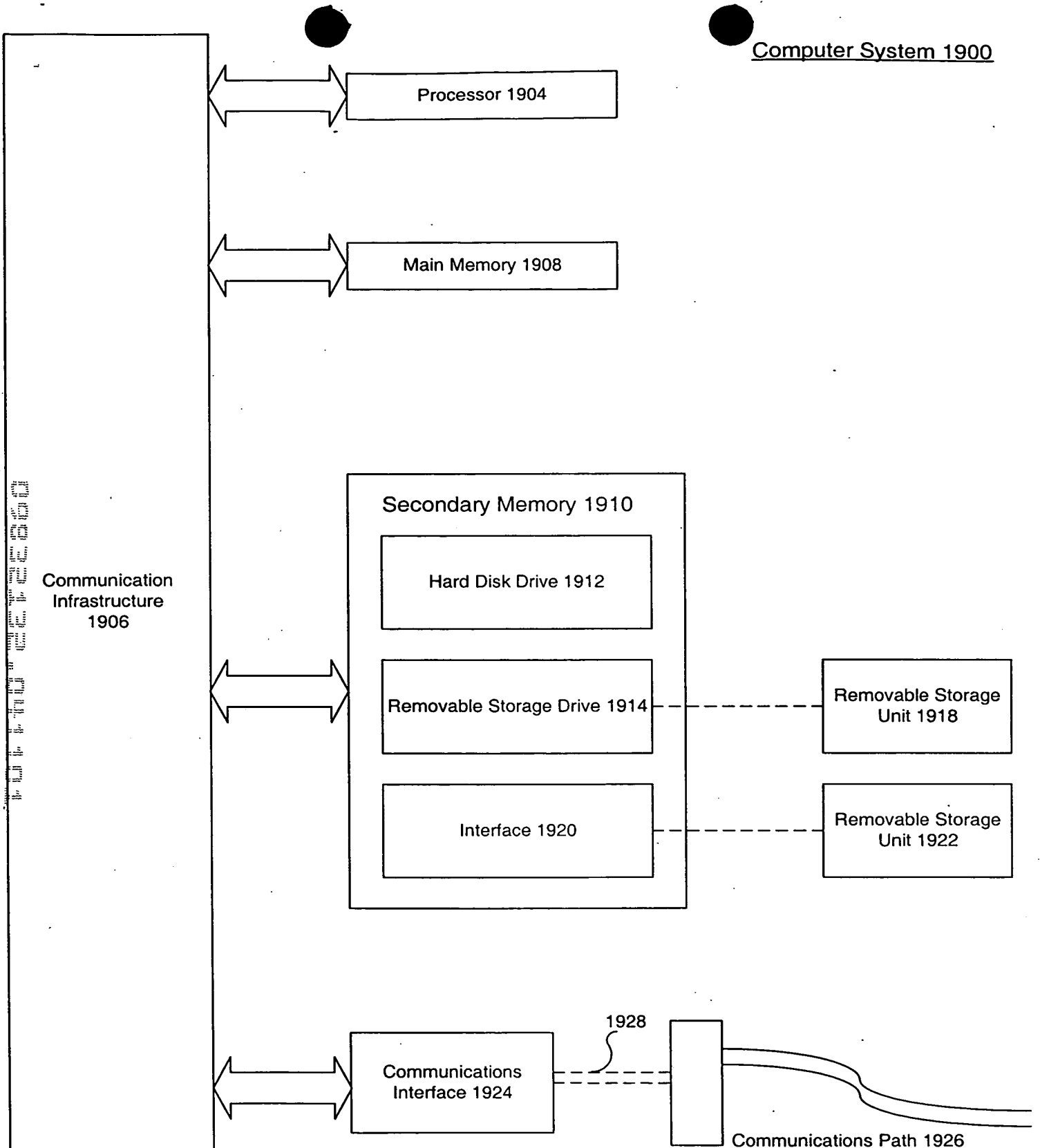


FIG. 19